Editorial

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Biographical notes: Jurij Šilc received his PhD in Electrical Engineering from the University of Ljubljana, Slovenia, in 1992. In 1980, he joined the Jožef Stefan Institute, where he is now a Senior Researcher. At the Institute, he served as the Head of the Computer Architecture Laboratory from 1986 to 1994. He is presently the Deputy Head of the Computer Systems Department and an Assistant Professor at the Jožef Stefan International Postgraduate School, Ljubljana. He has published over 200 research papers on subjects including magnetic bubble memories, dataflow computing, algorithm mapping, parallel processing, high-level synthesis, combinatorial and numerical optimisation, and processor architecture. He has been involved in a number of conferences and professional activities concerned with programming languages, parallel processing, computer architectures, and bioinspired optimisation algorithms. He is a member of the IEEE.

Bogdan Filipič received his PhD in Computer Science from the University of Ljubljana, Slovenia, in 1993. He is currently a Senior Researcher at the Department of Intelligent Systems of the Jožef Stefan Institute, Ljubljana, and an Associate Professor of Computer and Information Science at the University of Ljubljana. His research interests include stochastic optimisation, evolutionary computation and intelligent data analysis. He is also active in promoting these techniques in practical problem solving in engineering and industry. He has been a Principle Investigator in several projects dealing with optimisation of continuous casting of steel, scheduling of automobile production, optimal cargo transportation, and ICT for energy efficiency. He serves as a member of editorial boards of several scientific journals and a Programme Committee Member for the Genetic and Evolutionary Computation Conference (GECCO) and Congress on Evolutionary Computation (CEC).

1 Editorial preface

In nature, population members compete among themselves in the survival struggle, accumulate experience and improve their performance. Based on elementary activities of their members, biological societies self-organise into highly structured systems and exhibit complex emergent behaviour. These and similar natural phenomena have soon become a source of inspiration in computer algorithms design. Consequently, the family of bioinspired algorithms has been growing rapidly for decades and now includes evolutionary algorithms, ant colony optimisation, particle swarm optimisation, and artificial immune systems, to name just a few. They were created to overcome the shortcomings of traditional algorithms in demanding application domains where little information is available to assist problem solving. Optimisation is a particular field where these techniques are studied extensively and employed with great success.

This special issue contains extended versions of selected contributions to the field of bioinspired optimisation presented at the Fourth International Conference on Bioinspired Optimisation Methods and their Applications – BIOMA 2010 (`bioma.ijs.si`), held at the Jožef Stefan Institute, Ljubljana, Slovenia, on 20 and 21 May 2010. After a rigorous review by the members of the Conference International Programme Committee, six out of 18 papers presented at BIOMA 2010 were selected for this special issue. These papers deal with a wide range of problems and propose some novel techniques to solve these problems.

The first paper, entitled 'The slowness principle: SFA can detect different slow components in non-stationary time series', by Wolfgang Konen and Patrick Koch, addresses slow feature analysis, a bioinspired method for extracting slowly varying driving forces from quickly varying

non-stationary time series. It shows that it is possible for the slow feature analysis to detect a component which is even slower than the driving force itself.

The second paper is 'Analysis of exploration and exploitation in evolutionary algorithms by ancestry trees', by Matej Črepinšek, Marjan Mernik, and Shih-Hsi Liu. This work describes an ancestry tree-based approach for exploration and exploitation analysis in evolutionary algorithms. The approach relies on a data structure to record the evolution history of a population, and a number of exploration and exploitation metrics. It is tested on the multi-objective 0/1 knapsack problem.

The third paper, 'Two algorithmic enhancements for the parallel differential evolution', by Matthieu Weber, Ferrante Neri, and Ville Tirronen, proposes two algorithms based on parallel differential evolution. The first algorithm uses endemic control parameters within the parallel scheme where the differential evolution running at each subpopulation is associated with randomly initialised scale factor and crossover rate, which are then repeatedly updated during the optimisation process. The second algorithm decomposes the search space of large-scale problems into lower-dimensionality subspaces and assigns each of these to one subpopulation of a parallel differential evolution algorithm. Numerical experiments performed on ten test functions show the advantages of these algorithm extensions over simple parallel differential evolution.

The fourth paper in this special issue is 'MFGA: a GA for complex real-world optimisation problems', by Alessandro Turco and Carlos Kavka. This work presents a multi-objective genetic algorithm called magnifying front genetic algorithm, designed to treat complex real-world optimisation problems. Authors check the algorithm performance on a problem arising in multiprocessor system-on-chip design.

The fifth paper is entitled 'Days-off scheduling for a bus transportation company' and contributed by Jari Kyngäs and Kimmo Nurmi. The work focuses on staff scheduling, which is becoming increasingly important for both public sector and private companies. This paper describes a successful way to schedule days-off for the staff of a Finnish bus transportation company. The algorithm is a variation of the cooperative local search method.

Finally, in the sixth paper, 'MatPort – online mathematics learning with a bioinspired decision-making system', Barbara Koroušić Seljak and Gregor Papa present a methodology for learning elementary-school mathematics online. The methodology is supported by a decision-making system based on evolutionary computation, which leads a student in selecting an optimal subset of math items to effectively upgrade the knowledge.

We are grateful to the following external reviewers for their valuable contributions to the reviewing process: Christian Blum, Janez Brest, Dirk Büche, Carlos A. Coello Coello, Kalyanmoy Deb, Rolf Drechsler, Jürgen Jakumeit, Zbigniew Michalewicz, Edmondo Minisci, Nalini N, Jim Tørresen, and Xin-She Yang. Our thanks go to the authors who submitted high-quality papers and timely provided their revisions. Last but not least, we are deeply grateful to the Editor-in-Chief Nadia Nedjah and the publishing staff of *International Journal of Innovative Computing and Applications* for their support and guidance during the preparation of this special issue. As guest editors, we hope the readers will find the special issue interesting and informative, as well as that the papers will stimulate further progress in the field of bioinspired optimisation.